Key challenges for a sustainable food supply

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1 Executive statement

Food, the bedrock of life and the foundation of our physical, spiritual and emotional well-being, is at the heart of many of the critical environmental, social and economic challenges we confront in 21st century. Food sustainability, food security and feeding the 850 million who are hungry are central issues which now exercise the minds of businesses, governments and civil society as never before. Put this in the context of a population that will reach 9.3 billion by 2050 and changing dietary patterns, particularly in China and parts of the far East, the challenge becomes even more daunting.

This report focusses on a number of key sustainability challenges which we have to address if we are to accelerate the transition towards a more sustainable food system. These include climate change and water scarcity. Climate change is linked to changes in rainfall patterns, extreme weather events, and other impacts, presenting huge challenges for agricultural productivity. It isn’t just a question for adaptation, there is also the need for agriculture to cut emissions; global food production contributes 14-24% of all global GHG emissions. The impacts of climate change will be felt hardest through pressure on scarce water resources. Another key factor for the food system is a growing and elderly population. The latest projection from the UN suggests a population of 9.3 billion by 2050. Food security and nutrition are explored as the food system struggles to square the twin challenges of obesity and malnutrition whilst giving everyone access to healthy, affordable foods. Pressure on land and biodiversity are briefly explored as competition on land to provide enough food, fuel and fibre, whilst protecting key ecosystems, becomes more intense. Consumer attitudes are changing, urbanisation, the commercialisation of food systems and the globalisation of food trade have changed the way food is supplied and consumed. Nearly one billion people are overweight, the movement towards increased consumption of simple and refined carbohydrates and excessive saturated and trans fats is causing a decline of dietary diversity and health among the poor and rich alike. One third of all edible food produced is lost or wasted across the value chain. Addressing food waste and creating sustainable value chain networks, which improve livelihoods are also explored.

In order to address some of the challenges identified in this paper a systems approach is required which recognises that the activities undertaken in growing, processing, distributing and manufacturing our food are all connected. It requires new forms of collaboration and partnerships to address challenges which are often too big and complex for any one organisation to tackle alone. If we are to move towards a more sustainable food system, one that provides access to healthy and nutritious food for all, whilst restoring the natural environment, we will require innovation across the value chain –new forms of product and service innovation and new business models which will support this.

This report then explores some of the key opportunities for innovation; it has created a series of recommendations highlighting the areas in which the food industry needs to work together: a) empowered producers, b) restorative approach, c) resilient value networks, d) sustainable market mechanisms and e) connected consumers. Critically we hope this paper underlines the need to take a systemic approach to addressing some of the key challenges we have identified.

2 http://www.who.int/mediacentre/factsheets/fs311/en/
There are a huge range of issues that will impact on food in the future; this document is not designed to cover all these in detail. Rather, the insights should be seen as providing a fresh look and a challenge to existing thinking, as well as providing a few thoughts on some of the more systemic barriers and issues that relate to a sustainable future for food.
4 Background and overview

The global food system confronts many challenges in the 21st century. To feed the global population with healthy and nutritious food by 2050, the food system must simultaneously produce more food for a population expected to reach about 9.3 billion, improve livelihoods for the hundreds of millions of rural poor, and reduce environmental impacts, including ecosystem degradation, high greenhouse gas emissions and water scarcity. Whilst 850 million are still hungry and suffer from malnutrition, there is an emerging obesity crisis, impacting over 1.4 billion people, with knock on impacts on health care systems in many countries, within both the developed and developing world.

The scale of the problems we face and their relationship with the food system are now well recognised and have been covered by a number of seminal publications over the last few years. There is widespread agreement that today the global food system is unsustainable. Our global population is rapidly growing and becoming wealthier, one consequence being that our dietary patterns are changing and our demand for land, scarce resources and resource intensive foods, such as meat and dairy, continues to rise. At the same time the demands on our planet are on the increase. These conditions are further compounded by changing environmental conditions (increasing climate variability, water scarcity etc.) which make food production increasingly difficult or unpredictable in many regions of the world. Our food system also continues to undermine many of the key ecosystems and ecosystem services (e.g. pollination services) on which it ultimately depends.

Agriculture is the world’s largest use of land, occupying about 38% of the Earth’s terrestrial surface. The agricultural community has had tremendous successes in massively increasing world food production over the past five decades and making food more affordable for the majority of the world’s population, despite a doubling in population. In order to continue to meet the needs of a growing and changing population, the food system needs to deliver a new wave of innovation. Innovation which for example, tackles food waste, improves nutritional outcomes, increases resilience or restores the natural environment.

A food systems approach

Businesses, governments and other civil society organisations are increasingly recognising the importance of a food systems approach as the only way that we will be able to address some of the key challenges in sustainable food.

A systems approach recognises that the activities undertaken in growing, processing, distributing and manufacturing our food are all connected. For example, one way of dealing with the food poverty could be through tackling post-harvest losses. If perhaps we didn’t lose so much food at production level, then there might be more to go round. At Forum for the Future we have developed a change model which describes how system change happens. Much of our work focuses on how to deliver system innovation – a set of interventions that act together to shift a system.

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System innovation is exactly what is needed in the global food system.

Many organisations are hitting the limits of what they can do on their own. There is a need for new partnerships and forms of collaboration to tackle some of those shared challenges in the food system and this requires new business models, innovation, collaboration and partnerships involving stakeholders from across the food value.

Through effective diagnosis, innovation and scale; system innovation provides a necessary and achievable way forward. At its heart are new ways of doing things – be they a fresh mindset or a new technology, combined with multiple actions in different areas of behaviour change, policy, finance and culture.

In order to deliver a sustainable food system, there are three areas for action; rethinking value creation, reconnecting people with food and restoring ecosystems resilience. Rethinking how we create value is key for the future of how we produce food. The food system needs new business models which embed social, economic and environmental values across the value chain, whilst reflecting the true cost of food. The whole food supply chain must reconnect people with the food they eat, to help them value it more and to benefit local communities. Growing, cooking and celebrating food and connecting with those who produce food, is key if people are to value, use and dispose of food better. Ecosystem services are struggling with the fast pace of human development. Restoring resilience must focus on reducing our use of scarce natural resources, improving our ecosystems and the services they provide, moving towards closed looped systems and cutting food waste.

5 Barriers to a sustainable food supply

5.1 Climate change and water scarcity

The Intergovernmental Panel on Climate Change (IPCC) estimates a total average global warming of over 1.3°C by 2040. In addition to the direct effects of temperature increases, global warming has serious implications on climate system dynamics, leading to changes in rainfall patterns, extreme weather events, and other changes, presenting huge challenges for agricultural productivity.

The food system is faced with the double burden of both being severely impacted by climate change and greatly exacerbating climate change through added greenhouse gas (GHG) emissions; agriculture is responsible for 80-86% of all food-related global GHG emissions and 14-24% of total global emissions.

The need for our food system to reduce GHG emissions and adapt to the impacts of climate change in the future will become imperative. There will be a need for the food system to move towards sourcing more of its energy from renewable sources whilst looking at new forms of innovation to reduce energy use across the value chain. Energy prices are projected to rise and become more volatile over the next few years. Several parts of the food system are particularly vulnerable to higher energy costs – for example, the production of nitrogen fertilisers is highly energy intensive.

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3 http://ccafs.cgiar.org/bigfacts/global-agriculture-emissions/
By affecting agricultural productivity, climate change has already begun to impact crop yields, food prices, and livelihoods and as a result are starting to impact on food security and hunger outcomes. The world food crisis of 2007-2008 pushed 44 million people into severe poverty and hunger between June 2010 and February 2011 alone. Nearly half of the economically active population in developing countries—2.5 billion people—relies on agriculture for their livelihoods.\(^9\)

Climate change is expected to increase child malnutrition 20% by 2050.\(^10\)

Agriculture accounts for 70% of all freshwater drawn from rivers, lakes and aquifers, including 80-90% of water that is consumed and not returned. One-third of the world’s population lives in moderate to high water-stressed areas.\(^1\) With population growth, industrial development, and the expansion of irrigated agriculture, water demand in the next 20 years will exceed supply if business-as-usual approaches continue. The water gap is closely tied to food provision and trade.\(^12\) Population growth and globalization are increasing the demand for and availability of freshwater, resulting in widespread freshwater stress and vulnerability (see figure 1).\(^13\) Almost half the world population (47% or 3.9 billion people, which is one billion more people than today) will be living under severe water stress by 2030 if no new policies are introduced.\(^14\) This could equate to 62-76% of the global land area.\(^15\)

A recent study found that 20% of the world’s aquifers are overexploited, some even more so. The groundwater footprint for the Upper Ganges aquifer is more than 50 times the size of the aquifer.\(^16\) In China, 20% of the global population lives on only 5% of the world’s freshwater supply, the water table is falling fast and the price of water is rising. President Hu Jintao has noted that water shortages impact “China’s economic security, ecological security, and national security.”\(^17\)

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14. http://www.oecd.org/document/26/0,3746,en_2649_34283_40243802_1_1_1_1,00.html
17. http://www.ft.com/cms/s/0/7816d9c5-4f6c-11e1-8741-00144feabdc0.html#axzz1nsh0Qhfo
Climate change and water scarcity questions

- How can Europe food supply and primary production adapt to more extreme weather events?
- How can the sustainability of UK primary production be improved without expanding our social and environmental footprint overseas?
- How can water resources be better managed to improve water-use efficiency for food production?
- How can efficiency be improved and greenhouse gas emissions reduced with respect to water and energy inputs in food processing (e.g. reduction of heating then cooling or wetting then subsequent drying steps across the food chain)?

5.2 Demographic change

The UN’s median demographic projection suggests a population of 8.1 billion by 2025 and 9.3 billion by 2050. Over the next several decades, the global middle class is projected to more than double in size, from 2 billion people today to 4.9 billion in 2030. Population growth will create economic shifts, such as price volatility for commodities and inputs. Between 2006 and 2008, average world prices for rice rose by 217%, wheat by 136%, maize by 125%, and soybeans by 107%. Prices for meat, oils, dairy, and sugar have also been high and volatile (see figure below).

Figure 1.1. Commodity price variability has increased since 2006

As of 2008, more people are living in cities than in rural areas for the first time in history. Over the 20th century, the world’s urban population grew rapidly, from 220 million to 2.8 billion. By 2030, two out of

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20 http://www.reuters.com/middle-class-infographic
every three people are expected to live in a city; more alarmingly, one out of every three will live in a slum unless action is taken.24

Economic growth, urbanization, and rising incomes are leading to higher demand for convenient, processed foods, for meat, and for dairy products (a more Western diet) in large emerging countries.25 Urbanization is associated with dietary shifts towards more processed and pre-prepared foods, in part in response to long working hours and, for a proportion of the urban population, with reduced physical activity.26

Demographic change questions

- Will aspiring consumers in emerging economies follow the same food consumption model as in the West?
- Will China import more food and thus also water, nutrients and energy from other countries? How can it transform its own agriculture to produce enough food in a sustainable and safe manner?
- How can emerging economies direct more of its economic growth towards rural development and eradicating widespread poverty and malnutrition?

5.3 Food security and sustainable nutrition

The food system is increasingly interconnected and globalized. To meet market demands, value chains are longer and more complex. This complexity carries with it opportunities for growth into new markets; however, it is also prone to risks brought about by regulatory and non-tariff barriers, disruptions due to natural disaster, political upheaval and economic instability, rising oil prices and the effect on food production and transportation, and the dynamic and unrelenting variations in consumer demands and desires.

Projections show that feeding the population in 2050 would require a 70% increase in production from 2005-2050 with significant increases in key commodities. By 2030, demand for food will increase 50% (85% for meat).27 Demand for cereals and oilseeds are predicted to increase by 15-20% in the next decade, driven by consumption in emerging economies like Indonesia, Vietnam, and India.28

The need to feed the world’s most populous nation has seen Chinese firms buy up foreign dairy, sugar and cereal producers; Shanghai International’s $4.7 billion recent bid for top U.S. pork producer Smithfield Foods is one of the country’s latest acquisitions.

There is a push to get “more from less” as land, water, and energy resources available for food production are increasingly under pressure and unavailable. Precision agriculture uses ICT and other technology innovations to better analyze input requirements, leading to more exact application of inputs and increased resource use efficiencies.

The efficiency with which various livestock animals convert grain into protein varies: for feedlot cattle, it takes roughly 7 kilograms of grain to produce a 1-kilogram gain in live weight. For pork, the figure is close to 4 kilograms of grain per kilogram of weight gain, for poultry it is just over 2, and for herbivorous species of farmed fish (such as carp, tilapia, and catfish), it is less than 2.29

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24 http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2101
26 http://rstb.royalsocietypublishing.org/content/365/1554/2809.full
28 http://www.resourcesfutures.org/#!/emerging-consumers
29 http://www.earth-policy.org/books/pb2/pb2ch9_ss4
The production of 1 kilogram of beef uses 12 times the amount of water needed to produce 1 kilogram of wheat, and more than five times the amount of land.\(^3\)

Rising incomes in developing economies are correlated with the double burden of malnutrition and obesity. In India, 20% of the adult population is overweight and 20% of school-aged children are obese\(^3\); meanwhile, in some parts of the country, 42% of children under age 5 suffer from malnutrition.\(^2\) Mexico has the highest obesity rate in the world with 32.8% of the population classifying as overweight or obese; rates of obesity and overweight have tripled since 1980.\(^2\) Obesity continues to be a problem in developed countries, including the US (second to Mexico) and the UK (highest in Europe). In the US, more than one-third of adults (35.7% of the population) are obese.

One of the Millennium Development Goals seeks to reduce global hunger by 50% by 2015. Progress on reducing hunger has stalled since 2007 and nearly 1 billion (870 million) people are hungry (chronically undernourished)\(^3\) and more than twice that (2 billion) malnourished. In 2008, the FAO real food price index surpassed the 150 mark for the first time in almost 30 years\(^3\), pushing another 44 million people into severe poverty and hunger between June 2010 and February 2011 alone.\(^3\)

Most of the extreme poor depend on agriculture and related activities for a significant part of their livelihoods, thus, agricultural growth is particularly effective at reducing hunger and malnutrition. Social protection is also crucial for accelerating hunger reduction.\(^3\)

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**Food security and sustainable nutrition questions**

- What factors influence the allocation of food within Europe households, and what are the implications for health?
- How can the fat, sugar, preservative and salt content of foods be reduced while ensuring that palatability is maintained, waste is minimised, and food remains safe and does not spoil?
- How will novel, emerging and re-emerging pathogens be prevented, detected and controlled rapidly and accurately to enhance food security?
- Which EU groups (e.g. socioeconomic, regional) are, or are likely to become, food insecure in the near future, and why?
- How do we define a healthy and sustainable diet and what is the role of governments, businesses and civil society in driving healthy and sustainable food behaviours?

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**5.4 Land-use and biodiversity**

Agriculture occupies 40-50% of the Earth’s land surface\(^3\) (51% of the US land base\(^3\)). Per capita availability of arable and pasture land is plateauing or on the decline (Figure 2).\(^4\)

Figure 2. Arable land available in the world, developing countries, and developed countries out to 2050

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There is a growing trend towards schemes that incorporate a value for ecosystem services and the cost that occurs if these services aren’t or can’t be performed, such as payment for ecosystem services (PES).

Approximately 60% of global ecosystem services were found to be degraded or used unsustainably in the Millennium Ecosystem Assessment. These are resulting in nonlinear changes (including accelerating, abrupt, and potentially irreversible) that have important implications on human well-being. The harmful effects of the degradation or loss of ecosystem services are affecting the poor disproportionately.

Consumption of ecosystem services is expected to rise with GDP; most of the drivers will likely stay on the same trajectory out to 2050, with climate change and excessive nutrient loading becoming more severe. It is estimated that at least 35% of global crop production depends on natural animal pollinators. The most recent estimate of the global economic benefit of pollination amounts to some €265bn, assessed as the value of crops dependent on natural pollination.

The yield gap, how to close it? The collision of innovation, science and technology on farms is going to have a fundamental role on how to deliver a secure and sustainable food supply. There are likely to be some rapid advances in the fields of bio-technology (including nano-technology, use of enzymes, 3rd generation biofuels), crop protection and digital technologies. There is likely to be continued resistance to the adoption of some of these technologies from some civil society and consumer organisations.

Reducing the environmental impact of global protein consumption is of crucial importance if the food system is to meet the needs for future generations. Protein is at the heart of the sustainable food debate and is key if we are to address some of the 21st century environmental and social challenges. This, in the context of a rapidly growing worldwide demand for animal protein, such as meat and milk proteins, as a direct result of a burgeoning global population and changing dietary patterns in industrialized countries in Asia and South America.

Another challenge is the strong competition for land due to rising incomes in emerging markets and associated changes in dietary preferences (more meat and dairy) and the growth in crops for biofuel and animal feed. The US, the EU, & Brazil account for 80% of global biofuel consumption. However, there are currently biofuel mandates in at least 27 countries, with implications on land dedicated for food or fuel. As biofuel raises the rental rates of land, feedstocks displace food crops and force idled land back into production, with implications on both food supply and conservation.

The food vs. fuel debate remains contentious, with studies on both sides of the argument demonstrating a positive or negative correlation to rising food prices.
Land use and biodiversity questions

- How might we make farming more profitable and more sustainable in our generation?
- How can we transform the food system to ensure that healthy proteins, an essential nutrient for human health, are available to a global population estimated to reach from 7.5 to 9 billion people by 2050?
- How can we ensure proteins are produced within environmental limits and in a way that contributes rather than degrades key ecosystems?
- How can biotechnology best contribute to future food and nutritional security and serve the needs of the poor?
- How should EU soils be managed for optimum productivity and environmental protection in field vegetable, arable and grassland livestock systems in the long term?

5.5 Consumer behaviours and values

Today's health-conscious consumers are in favor of fresh, unprocessed, natural food.44 The number of shoppers under the age of 35 purchasing frozen foods today has decreased 37% compared to 2007.45

Consumers are willing to pay more for products labeled as produced in state or in a well-identified multi-state region.46 A study in South Carolina found that consumers are willing to pay significant premiums for locally produced foodstuffs (27% for local produce and 23% for local animal products).47 The number of farmer’s markets in the US increased 9.6% in the past year, maintaining the trend of steady increases since the US Department of Agriculture began monitoring local food in 1994.48 Some suggest that the recent increase in consumer demand for local foods is a result of food safety and health concerns, with huge implications for where foodstuffs are sourced and distributed.49

Sixty percent of consumers in developing markets are “willing to pay more for products with social and environmental benefits” compared to 26% of consumers in developed markets.50 On average, consumers are willing to pay a 17.3% premium for goods that provide a social or environmental benefit.51

Eighty percent of consumers (88% of consumers in emerging markets and 72% in developed markets) polled from six different countries consider it “very important or important” that their food and beverage purchases are “made with natural ingredients.”52 Nearly two-thirds (64%) of global consumers (78% in emerging markets and 52% in developed markets) seek food and beverage products “made with no genetically modified organisms.”53

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44 http://www.imgbranding.com/blog/2011/11/freshen-up-marketing-less-processed-foods/
46 http://ereae.oxfordjournals.org/content/early/2011/09/02/ereae.jbr039.abstract
48 http://1.usa.gov/RqoApz
50 http://theregenerationroadmap.com/files/reports/TRR_Rethinking_Consumption.pdf
Consumer behaviours and values questions

- What food information system would allow EU consumers to make an informed choice about each product's impact on different aspects of sustainability (environmental, economic, health and social)?
- Which intervention (or combination of interventions) would be most effective in achieving changes in consumption decisions and which types of intervention (e.g. awareness raising campaigns, choice editing, education, legislation or regulatory) are most appropriate for specific contexts and decisions?
- What dietary choices would EU consumers make if their intake of meat and dairy products was reduced, and what impact would this have on health and sustainability?

5.6 Food waste

With the heightened concerns over food security, food waste is coming under ever-increasing scrutiny: In industrialized countries, more than 40% of food losses occur at retail and consumer stages whilst in developing countries, more than 40% of food losses occur at post-harvest and processing phase\(^5\). Although global estimates of waste are reliant so far on a weak evidence base, there is little doubt that the scale is substantial. It has been estimated that as much as 30% of all food grown worldwide may be lost or wasted before and after it reaches the consumer. Some estimates have placed it as high as 50%. Addressing waste across the entire food chain will be critical in any strategy to feed nine billion by 2050.

![Figure 3. Showing per capita food losses at consumption and pre-consumption stages, in different regions.](http://www.fao.org/nr/sustainability/food-loss-and-waste/en/)

\(^5\) http://www.fao.org/docrep/014/mb060e/mb060e00.pdf

In developing countries food waste and losses occur mainly at early stages of the food value chain (on farm) and can be traced back to financial, managerial and technical constraints in harvesting techniques as well as storage – and cooling facilities. Thus, a strengthening of the supply chain through the support of farmers and investments in infrastructure (such as storage facilities) transportation, as well as in an expansion of the food – and packaging industry could help to reduce the amount of food loss and waste.  

The past decade has reversed a 100-year decline in resource prices because of a surge in demand for commodities. The volatility of resource prices today is at an all-time high. According to Monitor, the across-the-board rise in commodity prices observed over the last several years are likely to continue this decade and possibly beyond. This will be a key driver for improving resource efficiencies across the food value chain.

**Food waste questions**

- Under which circumstances are the various channels for using food waste (including anaerobic digestion, feeding it to animals, composting, land-spreading etc.) socially, environmentally and economically preferable?
- How can ways of influencing behaviour be most cost-effectively designed and targeted to reduce food waste in EU homes?
- How can waste of primary production be minimised by ensuring efficient conversion to secondary products?

### 5.7 Sustainable value chain networks improving livelihoods

A central feature of any sustainable value network is the need to **support livelihoods and empower producers** who grow our food. Thirty per cent of the world’s population was directly employed in agriculture in 2010, and small-scale agriculture provides up to 80% of the food consumed in developing countries. With poor rural households making up two-thirds of the global population earning less than $1.25/day, smallholder agriculture is also a critical source of income among the working poor. How our food is grown without causing any exploitation, dangerous conditions or unreasonably low wages, so that profits and value creation are not concentrated in small pockets of the value chain is key to the future sustainability of food.

Food needs to be produced in ways that empower producers (both farmers and workers) to own and control more of the value network. In many parts of the developing world a key focus will be around supporting women in agriculture.

A **restorative approach** to food production seeks to not only minimise agriculture impact on the environment but looks for ways to improve the natural capital on which it depends. Agricultural practices can often diminish the store of natural capital. Production methods need to be adopted that restore ecosystem services and landscape quality through practices such as reforestation, increasing biodiversity, improving water management and improving soil quality. In order to become **resilient** food production needs to adapt to the challenges of climate change and water scarcity. Food is a major contributor to climate change, and there will be a need to reduce emissions across the entire value chain. The need for **transparency** along all points of the food value chain is also key and this will also help connect consumers to producers and other organisations across the value chain, raising the profile of sustainability issues whilst creating more demand for sustainable products.

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57 [http://www.monitor.com/Portals/0/MonitorContent/Imported/MonitorUnitedStates/Articles/PDFs/Monitor_GBN_Winners_and_Losers_in_Commodity_Prices_July_11_2011.pdf](http://www.monitor.com/Portals/0/MonitorContent/Imported/MonitorUnitedStates/Articles/PDFs/Monitor_GBN_Winners_and_Losers_in_Commodity_Prices_July_11_2011.pdf)
6 Opportunities for innovation

The food system is facing critical challenges – in the next 40 years we will need to produce as much food as we did in the last 8,000 years. The intricacies of these challenges need a system approach. System innovation is a set of actions that shift a city, a sector, an economy onto a more sustainable path. System innovation is about tackling big challenges that are too large for any one organisation, however powerful, to solve on its own.

This paper has created a series of recommendations highlighting the areas in which the food industry needs to work together: a) empowered producers, b) restorative approach, c) resilient value networks, d) sustainable market mechanisms and e) connected consumers.

a) Empowered producers

Understand how a smallholder model could work successfully in different contexts and how it needs to be supported. This includes work on living wages, like the one begun by Oxfam involving different crop supply chains, in addition to considering the future role for production in the provision of in-kind benefits. It should also include what forms of collaboration are required to work ensure that human rights including gender equality are delivered through the value chain.

- Investigate and implement models to create greater value for producers, be that packing at source, capacity building and knowledge transfer or growing local market opportunities.
- Understand the potential impact of mechanisation on the employment of farm workers and the wider community and explore whether collaborative action could be taken to reduce the impact on vulnerable workers and how to make farm work more attractive.
- Develop radical transparency and traceability tools. In a recent transparency survey 86% of consumers surveyed say “ingredient transparency is extremely important or very important” (88% of consumers in emerging markets and 84% of consumers in developed markets). There has been a noticeable increase in transparency campaigns during the last few years, e.g. Oxfam’s ‘Behind the Brands’.

b) Restorative approach

Explore how the way we produce food could restore ecosystems and the ecosystem services on which our very food systems depend. How can we ensure the external costs of food production are reflected in the price of food we buy? We need to examine how a producer led sustainable landscapes approach could create greater understanding and deliver improved outcomes for the wider environment and community within which food is grown.

- Conduct further agricultural research in specific areas, such as developing drought-resistant crop varieties for different climates and locations, and improving soil fertility and water management.

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61 http://www.behindthebrands.org/en-us
Focus on improving productivity with fewer inputs to ensure that production continues long term.

Ensure knowledge is transferred to smallholders and research on improving productivity is shared more widely across the industry.

Explore how food can deliver additional benefits beyond producing food crops. This includes examining how growing different types of food can be aligned with food security, particularly at the early stages of growing food. Other benefits include: diversification; intercropping; carbon sequestration; and pest management.

c) Resilient value chain

Improve research and mapping of food growing areas likely to be affected by climate change. Share information between different agricultural sectors that are tackling climate change, and learn best practice within different sectors to scale up adaptation measures.

- Examine how food could play a part in carbon sequestration and access carbon financing.
- Scale-up existing low-carbon processing practices including the use of renewable energy in production and processing.
- Evaluate transport emissions; more investigation is needed about how they can be reduced and alternative models of supply and distribution need to be explored.
- Educate consumers on their role. Identify which foods have high emissions at the consumer end of the chain, and explore ways to influence consumer behaviours and how new technologies can support this.
- Improve composting and reduce waste on all levels of the value chain, production, distribution and consumption. Investigate and support innovation that allows waste to be used as a by-product for another industry or process. An example from outside the food system that provides a useful parallel is the Glocal project in Majorca by Ecover which explores how to use biotechnology and circular economy principles to create a business model for a cleaning product that works like an ecosystem.
- Reducing post-harvest losses, primarily in low-income countries can be tackled through:
  - Improvements to storage infrastructure and access to markets using existing knowledge.
  - Investment in new, appropriate technology to reduce post-harvest waste including the use of sensor technology etc.
  - The use of ICT (mobile devices etc.) to improve market information and access to the latest pest, disease and weather data.
  - In high income countries the focus should be on dealing with post-consumer food waste.
  - Campaigns to highlight the extent of waste and the financial benefits of reducing it.
  - Improvements in packaging technology (resalable packaging, on pack sensors)
  - Productive recycling of surplus food deemed as non-premium quality.

d) Sustainable market mechanisms

Investigate new and different financial and trading models to evaluate their ability to deliver sustainable outcomes and benefits for all players across the food sector. This includes specific areas such as payment terms and cash flow and wider questions, such as which crops will be desirable and needed in the future, where to grow them, what to grow and a clear regulation addressing competing uses for land, e.g. fuel, food or fibre.

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• Examine the future role of traders and intermediaries within the context of sustainable value networks and how they can help manufacturers and retailers understand the sustainability issued by producers, and do more to facilitate co-operation on addressing risks within the food value chain.
• Actively seek to be transparent, improve mechanisms to create clarity for all stakeholders at each stage in the process of how food is produced, distributed and delivered to consumers. An example of this is how John West has tracked its supply chain for a decade. It developed sustainability and marine biodiversity programme with Greenpeace and subsequently installed technology to trace tuna from sea to shelf using in-house software and technology. It produced data sets on its entire supply chain from catch method to origin and vessel.

e) Connected consumers

Raise the profile of food and sustainability issues in the supply chain through brands and consumer facing organisations, and in so doing create demand for more sustainable food which enables better social, environmental and economic conditions at the production end of the chain.

• Consumer behaviours drive change across the value chain. The food choices people make affect resource use, livelihoods and the wider economy. Use sustainability to pursue opportunities for product and service innovation. There are opportunities for creating multiple benefits, for example supporting consumers in reducing their energy and water use.

• Use new media and technology (such as; apps, internet of things devices to monitor consumers’ health, and social media) to reach consumers and create dynamism in the sector.

• Sustainable nutrition innovation is critical in reducing environmental impact and the number overweight people in the world. Dietary education programmes which teach people and create societal awareness, especially in emerging economies, on the benefits of eating fresh, local, seasonal foods to promote wellbeing are necessary to scale up sustainable nutrition. To eat for health is to practice Sustainable Nutrition and enjoy not only physical health, but mental, emotional, social, and spiritual growth.

62 http://www.john-west.co.uk/sustainability
64 http://www.baumancollege.org/pdfs/articles/Sustainable_Nutrition.pdf
7 Conclusions

This report presents some of the key factors that will affect the food sector in the coming years and sets out barriers and how systems thinking and collaboration could transform the supply chain into a value network. The report is a tool to help understand how factors such as the competition for land or consumer attitudes might develop, how they might interact and affect each other, and the implications this might have for the food sector.

Of course, understanding the need for change within the food system, and the principles that would make a sustainable food system, is only the beginning of the journey. Innovative action is now needed by all parts of the sector’s value network in all parts of the world – not just in Europe, but also in China, India, Africa, Latin America and South East Asia – to act on these opportunity areas for innovation and start to create a global sustainable food system.

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